Stockholm, and Vienna, he enjoyed, in addition, the freedom of practically every society or corporation devoted to the promotion of natural or technical knowledge within and beyond the British Empire. Not a few of these bodies have bestowed on Hooker still further distinctions. On the recommendation of the Royal Society he received a Royal medal in 1854; by the same society he was awarded the Copley medal, its highest honour, in 1887, and the Darwin medal in 1892. From the Society of Arts he received their Albert medal in 1883; from the Geographical Society their Founder's medal in 1884; from the Linnean Society their Linnean medal in 1888, a medal struck to celebrate his own eightieth birthday in 1897, and one of the medals struck in 1908 to commemorate the fiftieth anniversary of the publication of the joint communication of Darwin and Wallace on natural selection, in the original presentation of which to the society he had played so important a part. The Manchester Philosophical Society awarded him a medal in 1898, and in 1907 he received, in circumstances of singular dignity, from the Swedish Academy, what he himself has characterised as the crowning honour of his long life—the solitary medal, struck especially for the occasion, to commemorate the two hundredth anniversary of the birth of the great Linnæus.

Among his academic distinctions were the honorary degree of D.C.L., conferred upon him by the University of Oxford, and that of LL.D. from the Universities of Cambridge, Edinburgh, Dublin, and his own *alma mater,* Glasgow.

His foreign distinctions have included membership of the Royal Swedish Order of the Polar Star and the Royal Prussian Order "Pour le Mérite." By his own Government he was made a C.B. in 1869, the year following his presidentship of the British Association; he was made a K.C.S.I. in 1877, towards the close of his presidentship of the Royal Society. He was in 1897 promoted to the grade of G.C.S.I., when, in his eightieth year, the "Flora of British India" was completed; and in 1907, on his ninetieth birthday, he received the Order of Merit.

Hale and robust in his venerable old age, the veteran Hooker not only attended the Darwin-Wallace celebration organised by the Linnean Society in 1908, addressing the delegates and fellows present in a speech which recounted the part played by himself half a century earlier; he also attended the celebration at Cambridge in 1909 which commemorated the centenary of the birth of his friend Darwin. At work until within a few weeks of his death, and keenly interested in current topics to the last, Hooker passed peacefully away in his sleep, at his residence, The Camp, near Sunningdale, at midnight on Sunday, December 10. As was befitting, an invitation was offered to receive his remains in Westminster Abbey. Hooker had, however, expressed his wish that they should rest in the tomb in which his illustrious father's body was laid. This wish was fulfilled, and on Friday, December 15, he was buried in the family grave in the old churchyard of Kew. The *cortège* followed the coffin to the church, as was meet, from the house so long occupied by, and so full of memories connected with, his father and himself. At Kew, where so much of what he accomplished was done, he sleeps with his people, and Kew with its old churchyard is now more sacred even than it was to botanical pilgrims.

Among the mourners were the following members of the family, representatives of scientific societies and other institutions, and fellows of the Royal and the Linnean Societies:—

Lady Hooker (widow), Miss Grace Hooker (daughter), Mr. William Hooker, Dr. and Mrs. Charles Hooker, Mr. R. H. Hooker, Mr. R. S. Hooker, Sir W. T. Thiselton-Dyer, Miss Thiselton-Dyer, Mr. G. H. Thiselton-Dyer, Miss Symonds, Mr. R. Symonds, Mrs. Calverley-Bewicke, Mr. R. Woodward, Mr. R. Woodward, jun., Rev. G. Barker, Mr. G. Barker, Mrs. Crowder, Captain A. L. Henslow, Mr. Malleson, Mr. Murray, Miss Palgrave, Mrs. Paul Waterhouse, Miss M. Smith, Sir Arthur and Lady Rücker, the Hon. Mrs. H. Darwin, Mrs. Prain, Miss Younghusband, Mr. A. H. Lyell, Captain F. H. Lyell, Dr. Trail, Rev. A. G. Musgrave; the servants from The Camp, Sunningdale. Royal Society: Sir A. Geikie (president), Sir J. Larmor and Sir J. R. Bradford (secretaries), Lieut.-Colonel A. W. Alcock (council), and Prof. Bayley Balfour, Regius Keeper of the Botanic Garden, Edinburgh. Society of Antiquaries: Dr. C. H. Read (president). Linnean Society: Dr. D. H. Scott (president), Dr. B. D. Jackson and Dr. O. Stapf (secretaries). Geological Society: Prof. W. W. Watts (president), Prof. J. W. Judd (past-president). Royal Geographical Society: Mr. W. E. Darwin, Lieut.-Colonel H. H. Godwin-Austen. British Science Guild: Sir Norman and Lady Lockyer. Entomological Society: Prof. Meldola. British Medical Association: Mr. G. A. Peake. Royal Horticultural Society: Sir D. Morris, Mr. J. H. Veitch. Pharmaceutical Society: Mr. E. M. Holmes. University of Glasgow: Prof. F. O. Bower. Natural History Museum: Mr. E. G. Baker. West Indies: Mr. W. Fawcett. Royal Botanic Gardens, Kew: The Director, with the whole of the permanent staff, and with detachments representing the constabulary and the labour departments. Sir G. Darwin, Dr. F. Darwin, Sir A. Church, Prof. S. H. Vines, Mr. G. C. Druce, Prof. D. Oliver, Prof. F. W. Oliver, Mr. A. Henry, Dr. A. Günther, Prof. G. S. Boulger, Mr. J. S. Gamble, Mr. W. B. Hemsley, Mr. J. Britten, Mr. J. R. Drummond, and Dr. F. N. Williams.

NOTES.

We are pleased to be able to report that Dr. R. T. Glazebrook, the director of the National Physical Laboratory, who has for some time been seriously ill with enteric fever, has recently been making good progress towards recovery. A marked improvement has been shown during the last few days, and it is hoped that he may shortly be regarded as convalescent.

The Rt. Hon. the Earl of Cromer, G.C.B., and the Hon. Lionel Walter Rothschild, have been elected fellows of the Royal Society under the statute which empowers the council once in every two years to recommend to the society for election not more than two persons who in their opinion have rendered conspicuous service to the cause of science. The following have been elected foreign members of the Royal Society:—Dr. Johann Oscar Backlund, of Pulkowa, Imperial Astronomer of Russia; Dr. Heinrich Ritter von Groth, professor of mineralogy in the University of Munich; Heinrich Kayser, professor of physics in the University of Bonn; M. Joseph Achille Le Bel, of Paris, the distinguished chemist; and Klement A. Timiriazeff, professor of botany in the University of Moscow.

At a meeting of the executive committee of the British Science Guild, held on December 13, it was decided that the lecture scheme recently proposed should be commenced at the end of January. Sir Edward Brabrook agreed to read the first paper, on the scientific aspects of charitable effort. Prof. Perry will give a paper on problems in technical education in connection with national industries, and Mr. Frederick Verney on agricultural problems. After the reading of papers the meetings will be open for discussion. The meetings will be held in the rooms of the Chemical Society at dates to be announced later.

The conditions just issued by the War Office for the Military Aëroplane Competition have met with general approval, and as they are frankly based on the recent French competition rules, and call in some instances for more difficult tests, it is felt that the winning machines will represent the best productions at present obtainable. The prizes are divided into two classes: (*a*) For aëroplanes made in any country (open to the world), first prize, 4000*l.*; second prize, 2000*l.* (*b*) For aëroplanes manufactured wholly in Great Britain, except the engines (open to British subjects), first prize, 1500*l.*; two second prizes, 1000*l.* each; three third prizes, 500*l.* each. There are, in addition, consolation awards of 100*l.* each for ten machines which undergo all tests and do not receive a prize, and the War Office is to have the option of buying any of the prize machines at 1000*l.* apiece. The chief conditions to be fulfilled are as follows:—The machine, which must be a two-seater fitted with dual controls, must rise without damage from long grass, clover, or harrowed land in 100 yards in a calm, carrying a live load of 350 lb. in addition to instruments and oil and fuel for 4½ hours' running. In rising, the height of 1000 feet must be reached in five minutes, and it must fly for three hours continuously, of which time one hour must be passed at an altitude of 4500 feet. Before landing, a glide of not more than 1000 feet will be required, and the angle must be not less than 1 in 6. The landing must be made without damage on any cultivated ground, including rough plough. Among the desirable attributes of the aëroplane are mentioned a silencer to the engine, flexibility of speed, and an engine capable of being started from on board.

IT is with much regret that we see the announcement of the sudden death of Prof. Andrew G. Ashcroft, of the City and Guilds (Engineering) College, South Kensington, S.W., at fifty-two years of age. Prof. Ashcroft was a student at University College, London, and at the conclusion of his student career he was attached to the staff of the Engineering School. For some time he was engaged in constructional engineering work at the Alexandra Palace, and in other practical work of a similar nature. He returned to the Engineering School of University College, London, to act as assistant to Prof. T. H. Beare and Prof. (now Sir) Alexander Kennedy. Whilst acting in this capacity he lectured on engineering subjects at the East London College, then the People's Palace. At this period of his career, coincident with the recognition of the importance of technical education, he was appointed head of the Woolwich Polytechnic, and his work in this position showed that he was a shrewd and capable organiser. He left Woolwich to take up the work of assistant professor of civil and mechanical engineering at the Central Technical College, London. Prof. Ashcroft was keenly interested in the subject of the strength of materials, and was an expert in the measurement of small strains. Amongst other instruments, he designed an extensometer for measuring elastic strains; a delicate cross-strain measurer for the determination of Poisson's ratio; and a hand-testing machine for small tension pieces with a specially delicate autographic recorder. His written contributions to various societies include papers on properties of malleable iron, instruments of precision, and the measurement of air supply to internal-combustion engines. Prof. Ashcroft was a member of many societies, and took an active interest in the welfare of each one of the numerous social clubs which exist at the college where he worked. He was universally popular with the students, and the engineering profession is the poorer for the loss of so attractive a personality.

A SERIOUS explosion, resulting in injury to eighteen officers and men, occurred on December 12 during certain trials which were being carried out on board H.M.S. *Orion* at Portsmouth. From the newspaper accounts it appears that official tests of one of the dynamos were in progress when the explosion took place. The explanations put forward attribute the accident to the ignition of inflammable vapour given off from the oil used as a lubricant of the dynamo. One suggestion is that the production of vapour was due to overheating of the bearings: this would imply either that the lubricant was unsuitable or that it was not properly applied. Whether in this particular case the explanation is the true one or not, it seems at least probable. Lubricating oils are generally composed of high-density petroleum products, used either alone or mixed with a proportion of vegetable or animal oil. Numerous varieties are made to suit different types of machinery. For each type, of course, it is important to choose the appropriate lubricant. As regards inflammability, it is well known that petrol and ordinary petroleum oil for burning give off vapour at relatively low temperatures, but it is probably not so well recognised that at higher temperatures some lubricating oils may do the same. In fact, a determination of the flashing point, or at least a proof that the oil does not "flash" below a given temperature, is usually required in deciding upon the suitability of certain kinds of mineral oil for use as lubricants.

THE annual Christmas course of juvenile lectures at the Royal Institution will begin on Thursday next, December 28, at three o'clock, when Dr. P. Chalmers Mitchell will deliver the first of six lectures on "The Childhood of Animals."

AT the recent annual meeting of the Yorkshire Numismatic Fellowship, held at Leeds, Mr. T. Sheppard, of the Municipal Museum, Hull, was elected the president for the year 1912, and editor of the society's Proceedings.

A JOINT meeting of the Institution of Mining and Metallurgy and the Canadian Mining Institute will be held at Toronto on March 6, 1912, and the following days. The meetings for the reading and discussion of papers will occupy three days, March 6, 7, and 8. The annual dinner of the Canadian Institute will be held on March 8, and on March 9 an excursion to the mining districts of Cobalt and Porcupine will be arranged, provided a sufficient number of the members of the English institution wish to visit those localities. Further details of the arrangements may be obtained from the secretary of the institution, Mr. C. McDermid, at Salisbury House, London, E.C.

IN proposing the toast of "The Institution of Mining and Metallurgy" at the annual dinner of the institution, held on December 15 at the Savoy Hotel, Sir Alfred Keogh announced that the Bessemer Memorial Committee will, in January, hand over to the Royal School of Mines the laboratory which it has presented to the Imperial College of Science and Technology. Mr. Sulman, in responding to the toast, said that the world's production of gold in the form of standard metal since 1880 has exceeded 1,000,000,000*l.* sterling, more than one-half of which has been won from mines within the British Dominions. The British capital involved in metalliferous mining, apart from coal and iron, during the past twenty-five years exceeds 900,000,000*l.* sterling. During the past four years there has been subscribed as working capital for metalliferous mining, outside coal and iron, above 4,500,000*l.* sterling.

IT is well known that the late Mr. J. R. Mortimer, the Driffield antiquary, was an authority on the prehistoric and other earthworks of East Yorkshire, and during the past half-century he made a careful survey of all that remains relating to the military and domestic life of the early people who built them, a subject upon which he wrote many papers. Several of the structures which were known to Mr. Mortimer forty or fifty years ago, or less, have since entirely disappeared, as a result of agricultural and other operations. Fortunately, Mr. Mortimer carefully recorded his observations upon a large series of Ordnance maps of the district, and also particulars of the barrows, the Roman remains, the pits from which he obtained his geological specimens (most of which are now closed), &c. This valuable collection of maps has been presented by Major Mortimer to the Municipal Museum at Hull, where it can be referred to by students and others interested. In addition are large numbers of sketches, plans, photographs, negatives, &c., bearing upon East Yorkshire antiquities.

THE second annual general meeting of the Society of Engineers (Incorporated) was held on December 11, Mr. John Kennedy, vice-president, being in the chair. The following were elected as the council and officers for 1912:—*President,* J. Kennedy; *vice-presidents,* A. Valon, H. C. H. Shenton, N. Scorgie; *members of council,* H. Adams, C. T. Walrond, P. Griffith, T. E. Bower, H. C. Adams, J. R. Bell, S. Cowper-Coles, H. P. Maybury, B. H. M. Hewett, F. H. Hummel; *associate member of council,* E. Scott-Snell; *hon. secretary and treasurer,* D. B. Butler. It was announced that premiums for papers read at meetings and published in the Journal during 1911 had been awarded as follows:—the president's gold medal to Mr. W. R. Baldwin-Wiseman, for his paper on the administrative aspect of water conservancy; the Bessemer premium of books or instruments, to the value of 5*l.* 5*s.*, to Mr. R. W. A. Brewer, for his paper on two-stroke cycle engines; the Clarke premium, value 5*l.* 5*s.*, to Mr. T. J. Gueritte, for his paper on the mechanical installation and upkeep of permanent way on railways; a society's premium, value 3*l.* 3*s.*, to Mr. E. Kilburn Scott, for his paper on nitrogen products made with the aid of electric power; a society's premium, value 3*l.* 3*s.*, to Mr. Frank G. Woollard, for his paper entitled "Some Notes on Drawing-office Organisation."

THE annual general meeting of the Scottish Meteorological Society was held on December 12. From the report of the council, which was adopted at the meeting, we learn that during the past twelve months several additions have been made to the society's system of stations. A fully equipped station has been established by Mr. G. Craig Sellar at Ardtornish, on the Sound of Mull, and represents effectively an interesting region from which observations were greatly needed. New stations have also been established at Aviemore by the Aviemore Station Hotel Company, and at Carrbridge by the Rev. Andrew Doak, and these will add to the scanty knowledge of the meteorology of the Central Highlands. The council points out once more that there is urgent need for additional information regarding the rainfall of the Highland area and the north of Scotland. Apart from the purely scientific value of rainfall records, the rainfall of a district touches practical and sporting interests at many points, and it seems to the council that it may reasonably look to large landowners and shooting tenants for help. It may be pointed out that the final report of the recent committee of inquiry on grouse disease has something to say on the importance of meteorological conditions in relation to the distribution and the health of grouse. It appears that where rainfall is very heavy there is little disease, but grouse are few, the scarcity of the birds being due probably to the deleterious effect on heather of a high rainfall. The council elected for the ensuing twelve months is as follows:—*President,* Prof. A. Crum Brown, F.R.S.; *vice-presidents,* Ralph Richardson, W.S., Dr. C. G. Knott; *council,* Sir David Paulin, Gilbert Thomson, H. M. Cadell, Sir A. Buchan-Hepburn, Bart., G. G. Chisholm, M. M'Callum Fairgrieve, J. Mackay Bernard, Dr. J. R. Milne, T. S. Muir; *hon. secretaries,* R. T. Omond, E. M. Wedderburn, W.S.; *hon. treasurer,* W. B. Wilson, W.S.

IN a report presented to the French Institute of Anthropology, published in *Comptes rendus* for March-June, M. Boule discusses the morphology of the mammoth as displayed in recent discoveries of Palæolithic art. He points out that certain physical peculiarities of the animal, which were only recently established by the discovery of a specimen by M. Wollosowitch at Sanga-Iurach in 1908, already appear in stone carvings dating from the Palæolithic age.

IN vol. xxii., Nos. 4–5, of *L'Anthropologie,* Dr. Lalanne and L'Abbé H. Breuil describe a series of remarkable Palæolithic sculptures on a cliff at Cap-Blanc, Laussel, Dordogne. Among the animals represented are a bison and a pair of horses, depicted in the usual vigorous style of the art of that period. This discovery supplies a welcome addition to the cave sculptures of a similar class already familiar to archæologists. It is now proved that these early artists, in addition to work carried out by torchlight in dark, damp caves, executed similar sculptures in the open air.

THE work of the modern school of French anthropology is largely devoted to the preparation of elaborate memoirs in which the results of the investigation of specially interesting races are summed up and criticised, with a complete apparatus of facts and statistics. Such is the admirable account contributed to vol. xxii., Nos. 4–5, of *L'Anthropologie* by Dr. Poutrin, entitled "Les Négrilles du Centre Africain (type sous-dolichocéphale)," in which he has collected all the information at present available on the Pygmy races. The introduction, illustrated by a map, shows the distribution of these people, and is followed by a historical account of exploration and an elaborate survey of the physical characteristics. Probably no account of this remarkable race, already available to students, contains a more complete survey of the ethnological problems connected with the Pygmies of Africa.

ACCORDING to the fourth annual report (1910–11) of the National Museum of Wales, the designs for the new building have been considerably modified, with, it is believed, a great improvement in the general appearance of the structure. Illustrations are given of the exterior and of the entrance hall, together with plans of the ground-floor and the two floors above. A contract has been signed for the construction of the basement and sub-basement for that portion of the building proposed to be erected in the first instance, which includes the south block and the lecture theatre and gallery above, and work on this was commenced in September last. Considerable progress has been made in collecting specimens for exhibition and study.

WE have received a copy of a petition from the natives of India presented to H.M. the King at the Delhi Durbar (together with a covering appeal signed by K. S. Jassawalla, of 45 Courthope Road, Hampstead), praying that the supply of beef required for the British Army in India may in future be obtained from Australia in place of India itself. The petition is accompanied by a large illustration showing the various uses to which Indian cattle are put. So great is the demand in the country for cattle for purposes of draught and agriculture that, according to the petition, cows are chiefly slaughtered for beef. This practice is one of the causes which have led to a great diminution in the number of cattle in the country, with a corresponding rise in the price of milk and ghi (native butter). It is further urged that the quality of Indian beef is far inferior to that of Australian beef, and likewise that the use of the latter in the Army commissariat would not entail any very great additional cost.

MR. A. H. THAYER's suggestive observations upon protective coloration in nature have been described in these columns on more than one occasion, and his son's beautifully illustrated work upon it was reviewed in detail a little more than a year ago (October 27, 1910). A number of illustrations from that work are reproduced in colour in the December number of *Pearson's Magazine*, and the principle they exemplify is described in an instructive article by Mr. Marcus Woodward. Mr. Thayer's view is that it is the rule for animals to be coloured like the background which most concerns their feeding and escape from attack. There are limitations to the application of this interpretation of obliterative colouring throughout the animal kingdom; but there is no question as to the great importance of the principle of countershading in nature, and the article and pictures in *Pearson's Magazine* should be the means of interesting many people in it.

THE latest issue of *The Kew Bulletin* (No. 9) is mainly occupied by systematic articles. The most interesting is a description of six new species of Impatiens from Travancore and Cochin, contributed by the late Sir Joseph Hooker. The list of additions to the wild fauna and flora of the gardens is due in great measure to the collection of specimens by members of the garden staff. Noteworthy is the announcement of a heath from Cornwall which appears to be a natural hybrid between *Erica tetralix* and *E. vagans.*

THE annual Kew list of seeds of hardy herbaceous plants and of trees and shrubs available for exchange with botanic gardens and regular correspondents has been published as Appendix I. to *The Kew Bulletin* (1912). The list reflects in some measure the outcome of the remarkably fine summer, notably in the ripening of the seeds of trees and shrubs; thus there are offered for exchange the seeds of *Clerodendron dichotomum*, which has fruited at Kew for the first time on record, *Koelreuteria paniculata*, *Buddleia globosa*, and two species of Halesia.

BOTANICAL exploration in India is summarised by Major Gage, as director of the botanical survey, in his report for the year 1910–11. An expedition to the south-east corner of Sikkim was undertaken by Mr. W. W. Smith. Captain R. W. Macgregor presented an interesting collection of specimens from the Southern Shan States, and a smaller collection was forwarded by Mr. Burns from Bombay. In the south, the most important contribution was made by Mr. A. Meebold, as the result of an extensive tour through the States of Cochin and Travancore. A second fasciculus of the catalogue of non-herbaceous phanerogams cultivated in the Calcutta Botanical Gardens has been published as vol. v., No. 2, of the Records of the Botanical Survey of India.

ON Monday, December 18, Dr. D. T. Macdougal, director of the department of botanical research of the Carnegie Institution of Washington, lectured before the Royal Geographical Society on the North American deserts. After describing the general characters of desert areas, and explaining the importance of the various factors involved, he passed on to give a short account of the study of such regions which is being carried on by the Carnegie Institution. A large series of lantern-slides, many of them in colour, showed very instructively the character of the desert regions of Arizona and California, and of the types of vegetation which are able to flourish there both under normal conditions and also by the aid of artificial constructions, such as the concrete walls which are sunk in the detritus-filling valley floors in order to hold up to a higher level the water, which otherwise flows at a depth which is out of the reach of surface vegetation. The formation of the Salton Lake was also described, and its effect on the vegetation of the basin was illustrated. Dr. Macdougal is leaving shortly to visit the deserts of Egypt and the northern Sudan.

IN the Monthly Meteorological Chart of the Indian Ocean for December, issued by authority of the Meteorological Committee, a considerable space (as in previous months) is devoted to a useful discussion of ice reports, relating to the southern hemisphere, which subject has for many years occupied the serious attention of the office. In the Southern Ocean icebergs are most frequently met with to the north-east of Cape Horn, south-east of the Cape of Good Hope, midway between Kerguelen and the meridian of Cape Leeuwin, and midway between New Zealand and Cape Horn. Tables of the monthly and annual frequency of the bergs from 1885 to 1910 show that the periods of maxima and minima vary irregularly; the years of greatest frequency were 1893 and 1906. In the chart for the North Atlantic the ice conditions are also discussed. A sub-chart of the exceptional drifts and heights of bergs shows that the latter were most frequent in the ten-degree square of lat. 40°–50° N. and long. 40°–50° W., but some few were observed nearly so far south as lat. 30° N. The first ice seen in 1911 was on January 28, near lat. 47° N. and long. 52° W.

IN an interesting paper recently published in the *Bollettino* of the Italian Seismological Society (vol. xv., 1911, pp. 144–53), Prof. G. Grablovitz has traced the variations in the mean level of the sea at Ischia during more than twenty years. From 1890 to 1894 the mean level furnished by the mareograph records remained not far from constant, but from 1895 onwards there has been a marked change, after the effects of barometric variation have been allowed for. The change is not always in one direction; but during the sixteen years from 1895 to 1910 there has been, on the whole, a rise in the sea-level, the average annual amount being 3 or 4 millimetres a year. The mareograph records at Genoa also indicate a gradual, though much less pronounced, rise in the apparent level of the sea.

IN his well-known investigations on the after-shocks of earthquakes Prof. Omori finds that the law of decline in frequency is of the form $y=k/(x+h)$, where y is the daily number of after-shocks at time x after the parent earthquake, and h and k are constants which vary with every earthquake. Mr. A. Cavasino has recently examined the validity of this formula in regard to the after-shocks of the Riviera earthquake of 1887, one of the first earthquakes in which the after-shocks were studied in detail (*Boll. della Soc. Sismol. Ital.*, vol. xv., 1911, pp. 129–43). Determining the values of the constants from the recorded numbers of sensible shocks during the first five days, he shows that the agreement between the numbers furnished by the formula and of those actually observed is at first fairly close, but that, after the lapse of a few years, the formula fails to give correct results. The discrepancy may be due partly, as he suggests, to the difficulty of determining the average seismicity of the district. It may also be due to the small number of records used in determining the constants of the equation.

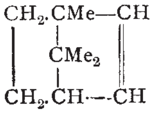
IN the *Atti dei Lincei*, xx. (2), 6, Prof. A. Garhasso describes a repetition, with modern apparatus, of the classical experiment of Volta and Bennet, according to which the flame of a candle discharges the conductor of an electroscope. In this case a Ramsden's electric machine and an Exner electroscope were used at a distance of 15 metres apart, and it was observed that on working the machine the electroscope readings increased; on stopping it they decreased, then rose to a maximum, and then again fell.

SIR GEORGE GREENHILL, writing in *The American Journal for Mathematics*, xxxiii., 4, develops the result obtained by G. W. Hill, according to which the potential of a homogeneous spherical segment (*e.g.* a flat lens) at any point can be made to depend on elliptic integrals. This result depends on the method of dissection employed; in this case the segment must be supposed cut into slices perpendicular to the line joining the centre to the point at which the potential is required.

ACCORDING to a paper by Messrs. Kinoshita and Ichinohe in vol. iii. of the Memoirs of the Science and Engineering College of the University of Kyoto, the ionisation current from a metal filament when heated above 2400° absolute ceases to be represented by Prof. Richardson's equation $C = A\sqrt{\theta}.e^{-b/\theta}$, where C is the value of the saturation current, θ the absolute temperature, and A and b constants depending on the nature of the metal. They put this down to the fact that the equation is deduced on the assumption that the whole of the saturation current is carried by the ions emitted by the heated filament. At the high temperatures they attained they consider the kinetic energy of the moving electrons sufficient to enable them to ionise the gas molecules with which they come into contact. The magnitude of the current thus produced appears to be roughly half that of the total current observed.

THE *Verhandlungen der Deutschen Physikalischen Gesellschaft* for November 15 contains a short report laid before the meeting of the Naturforscher und Aerzte at Karlsruhe by Drs. Scheel and Heuse, on the measurements of the specific heat of air at ordinary and at very low temperatures recently made at the Reichsanstalt. The method used was that of "continuous flow," the air passing through a vacuum-protected tube in which it was heated by a wire carrying an electric current, its temperature on entering and in leaving being measured by platinum thermometers. The results for the specific heat are as follows:—at 20° C., 0·241; at −78° C., 0·243; at −183° C., 0·252. There is, therefore, a distinct increase of the specific heat as the temperature decreases. The result at 20° C. agrees to within 1 part in 1000 with that obtained by the same method by Dr. Swann, and published in the Proceedings of the Royal Society of London in 1909. The complete account of the work of Drs. Scheel and Heuse is to appear in the *Annalen der Physik*.

THE November issue of the Chemical Society's Journal contains a paper by Prof. G. G. Henderson and Mr. I. M. Heilbron on the constitution of camphene. It is now generally recognised that the formula I., originally proposed by Bredt, is in reality that of the closely related bornylene, as is shown by its preparation from borneol through the xanthate, and by the ease with which it is converted into camphoric acid by oxidation. A great many of the reactions of camphene indicate the presence of the methylene group $>C{=}CH_2$ in this compound, and on the basis of much experimental evidence the authors consider the formula II., originally proposed by Seminler, to be the best expression of the known facts.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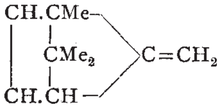
II. Camphene.

AN interesting case of isomerism is discussed by Messrs. Laws and Sidgwick in the November number of the Chemical Society's Journal. The phenylhydrazone of acetaldehyde possesses the remarkable property that the α-form, melting at 98°, and the β-form, melting at 56°, can be converted almost quantitatively one into the other by the action of a mere trace of acid or alkali; thus crystallisation from aqueous alcohol containing a trace of potassium hydroxide gave the high-melting α-form, whilst recrystallisation from aqueous alcohol containing a trace of sulphur dioxide gave the low-melting β-form. This peculiarity of the isomerism is obviously connected with a very small difference in the energy-content (and therefore in the stability) of the two forms. This factor is usually overbalanced by a marked difference in the solubility of the two forms, a difference which sometimes favours either the one or the other form according to the solvent from which the material is crystallised. But in the case under consideration the difference of solubility almost disappears on account of the fact that the two forms are isomorphous. Their interconversion can therefore take place with peculiar facility, and in the case of the solids may be brought about by gaseous acids and alkalis without producing any alteration in the appearance of the crystals.

Engineering for December 15 contains an account of some valuable experiments on the strength of thick hollow cylinders under internal pressure, carried out by Messrs. Gilbert Cook and Andrew Robertson at the University of Manchester. The object of the experiments was to test the various theories for the manner of failure, and cylinders both of cast iron and of mild steel were tested. In the case of cast iron, elastic limit and rupture are practically coincident; the results of the experiments show that the failure is determined solely by the maximum principal stress, and Lamé's formula,

$$p = f\frac{k^2 - 1}{k^2 + 1},$$

may be used directly. In this formula f is the stress at failure in simple tension, and k is the initial ratio of the diameters. In the mild-steel cylinders tested, initial yield took place when the pressure was about 20 per cent. in excess of that required by the shear-stress theory (Guest's law); the pressure may be calculated very nearly by the equation

$$p = 0{\cdot}6f\frac{k^2 - 1}{k^2}.$$

Tests were also made on the ultimate strength of mild-steel cylinders. The results may be denoted empirically by the same formula that applies to cast iron.

WE have received from Messrs. James Woolley, Sons and Co., Ltd., of Victoria Bridge, Manchester, a copy of their "Scientists' Reference Book and Diary for 1912." In addition to a conveniently arranged diary, in which each week of the year is given a page, a reference book containing useful information as to important facts and constants continually required by workers in science is provided. The tables and other data have been carefully revised, and will prove of great service. The price of the publication is 1*s*. 6*d*.

The report of the Clifton College Scientific Society for the year 1910–11 has been received. This year, for the first time, the report is illustrated. The numerous sections of the society were very active during the period under review, but the attendance at general meetings does not appear to have been so good as in previous sessions. The report shows that many of the masters join with the boys in their practical study, in leisure hours, of various branches of science. Great prominence is given to outdoor work of a kind likely to engender a love for scientific observation and research among the boys.

The issue of "Hazell's Annual" for 1912 maintains the high character for usefulness which previous editions of this work of reference have gained. The contents have been revised to November 25 last, and the editor, Mr. Hammond Hall, claims that the compilation gives "the most recent and authoritative information on the topics of the day." One section of the volume, running to forty-two pages, is entitled "The March of Science," and deals, among other subjects, with scientific progress in 1911, imperial research, and aërial navigation. This is the twenty-seventh year of issue of the annual. The price of the volume is 3*s*. 6*d*. net.

Copies of the 1912 issues of the well-known works of reference published annually by Messrs. A. and C. Black have been received. "Who's Who" is larger than ever; the 1911 edition ran to 2246 pages, but the new volume contains 2364 pages. There is a remarkable variation in the lengths of the autobiographies contained in this indispensable volume; some consist of two or three lines only, while others take up nearly a page. It is satisfactory to find, in view of the important part which science takes in modern States, that due prominence is given to men of science in this record of living notabilities. "Who's Who Year-book" contains, as usual, the well-arranged tables which were formerly a popular feature in "Who's Who" itself. "The Englishwoman's Year-book and Directory" should be in the hands of every woman who is engaged in public work; it is crammed with useful information of a trustworthy kind. "The Writers' and Artists' Year-book" is, its editor says, chiefly for the use of those persons who wish to make money by their pen or brush.

OUR ASTRONOMICAL COLUMN.

Mars.—In a telegram, dated November 29, from Setif, to the *Astronomische Nachrichten*, M. Jarry-Desloges states that Mare Sirenum is persistently seen cut into three parts, and that Elison is easily perceptible. Later, on December 4, he reports that Juventæ Fons is now an easy object, L. Phœnicis is triple, Bathys is apparently effaced, the Aonius Sinus encroaches on Thaumasia, and the south polar spot, in 95°, is 0·7″ in diameter.

The December number of *L'Astronomie* contains several drawings of the planet by M. Quénisset and others, with descriptions of the different features observed during October and November. The outstanding feature on October 17 was Tartarus, which, leaving the M. Sirenum at its eastern point, traversed nearly the complete disc and joined up with Trivium Charontis.

On photographs taken on one plate by Prof. Lowell on October 11, M. Flammarion has recognised fifteen different Martian features in the L. Solis region, including several canals.

Borrelly's Comet, 1911*e*.—Dr. Ristenpart communicates the position of comet 1911*e*, as observed at Santiago on November 26, to No. 4541 of the *Astronomische Nachrichten*, and adds that the comet was round, was less than 1′ in diameter, had a nucleus and a tail, the latter less than 30′ long, and that its magnitude was 9·0; the corrections to the ephemeris at 10h. 57·6m. (Santiago M.T.) on November 26 were +0·3′ and +0·2′.

Spiral Structure in Nebulæ.—In an interesting article published in No. 3, vol. xxxiv., of the *Astrophysical Journal*, Mr. William Sutherland discusses the relation between the distribution of the planets and the probability of their origin in a spiral nebula. He shows that the equation expressing Bode's law may be developed to show that the planetary distances are derived from two equiangular spirals, thus leading to the idea that the solar system in its evolution passed through the spiral form so common among nebulæ, the spiral being of a simple logarithmic form. He pictures the elementary nebula as made up of meteorites rotating about a centre, the meteorites being uniformly distributed. Collisions occur, reducing the rotational velocity of the colliding bodies, and the latter fall towards the centre; but they will fall spirally, owing to the common rotation of the mass, and thus spirals of condensation would be formed. Mr. Sutherland shows how these might finally agglomerate into two-armed spirals, in which local condensations might account for the considerable variation of mass among the planets; according to this scheme, the moon and other satellites were formed from subsidiary branches to the spiral arms. Comparisons between the calculated spirality of several nebulæ and that calculated for the solar nebula from the law of distribution of the planets shows the values to be of the same order, and thus lends support to Mr. Sutherland's theory.

Permanent Designations for Recently Discovered Variable Stars.—In No. 4540 of the *Astronomische Nachrichten* the commission for the A.G. catalogue for variable stars publishes the permanent names allotted to variable stars discovered recently. From the notes it is seen that most of the discoveries were photographic, and that many of them were made at Harvard. A glance at the tabulated maxima and minima suggests that the field of discovery for variable-star observers is not yet closed, for we find ranges of three or four magnitudes, *e.g.* 9·5 to 12·8, among the fainter objects.

Luminosities and Radii of Various Stars.—Answering a question as to the relative sizes of the stars, Mr. J. B. Cannon, of the Dominion Observatory, gives some interesting figures in No. 5, vol. v., of the Journal of the Royal Astronomical Society of Canada; he also outlines the method whereby the figures were derived.

As the surface intensities of the various spectral types, taking that of the sun as unity, he adopts 12 for types A and B, 3 for type F, 1 for type G, and 0·5 for types K and M, and derives the luminosities and radii of eighteen well-known stars. Rigel, with a radius 41·5, has a luminosity 20,614 times that of the sun. Only two stars, α Aquilæ and β Leonis, are calculated to be the same size as the sun, and are just over twelve times as luminous. The radius of the Pole Star is 5·9, and its luminosity 102, while Regulus, with six times the radius of the sun, is 423 times as luminous.

THE PHYSICAL SOCIETY'S EXHIBITION.

The seventh annual exhibition of physical apparatus under the auspices of the Physical Society of London was held on Tuesday afternoon and evening, December 19, at the Imperial College of Science and Technology. The very large attendances at both sessions was evidence that the exhibition continues to serve a very useful purpose in bringing a knowledge of new apparatus to teachers and others interested in scientific work.

A discourse was given by the Hon. R. J. Strutt, F.R.S., at each session on electric discharge and the luminosity that survives it, in which the lecturer displayed some interesting and very pretty experiments on the afterglow which succeeds the passage of an electric discharge through nitrogen. A current of pure nitrogen was maintained through the discharge tube and passed into a large globe, in which it still maintained a yellow glow. The interaction of nitrogen in this state with nitric oxide and stannic chloride vapours was shown by the change in the colour of the glow to green and blue respectively when the vapours